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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
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10/643,680

08/18/2003

Brenda D. Kraus

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EXAMINER

TALBOT, BRIAN K

ART UNIT

PAPER NUMBER

1762

MAIL DATE

DELIVERY MODE

08/14/2007

PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary

Application No.

10/643,680

Applicant(s)

KRAUS ET AL.

Examiner

Brian K. Talbot

Art Unit

1762

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --
Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 04 June 2007.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-8, 10-17, 22-25 and 29-68 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) 26-28 is/are allowed.
- 6) ☒ Claim(s) 1-8, 10-17, 22-25 and 29-68 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
- ☐ Certified copies of the priority documents have been received.
 - ☐ Certified copies of the priority documents have been received in Application No. _____.
 - ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☐ Information Disclosure Statement(s) (PTO/SB/08)
Paper No(s)/Mail Date _____
- 4) ☐ Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____
- 5) ☐ Notice of Informal Patent Application
- 6) ☐ Other: _____

Continued Examination Under 37 CFR 1.114

1. A request for continued examination under 37 CFR 1.114, including the fee set forth in 37 CFR 1.17(e), was filed in this application after final rejection. Since this application is eligible for continued examination under 37 CFR 1.114, and the fee set forth in 37 CFR 1.17(e) has been timely paid, the finality of the previous Office action has been withdrawn pursuant to 37 CFR 1.114. Applicant's submission filed on 6/4/07 has been entered.
2. Claims 9 and 18-21 have been canceled. Claims 64-68 have been added. Claims 1-8, 10-17 and 22-68 remain in the application.
3. The text of those sections of Title 35, U.S. Code not included in this action can be found in a prior Office action.
4. This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

Claim Rejections - 35 USC § 103

5. Claims 5-8,11,12,14,15,17,29 and 65-68 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kang et al. (7,098,131).

Kang et al. (7,098,131) teaches a method of forming atomic layers and thin films including tantalum nitride and devices including the same. A tantalum amine derivative reactant (which is a amido or imido metal organic compound) is introduced onto a substrate, chemisorbing a portion of the reactant on the substrate, removing non-chemisorbed reactant from the substrate and introducing a reactant gas onto the substrate to form the nitride film (abstract). TiN can be formed on the substrate by introducing a reacting gas to remove a ligand-bonded element from the chemisorbed reactant. The ligand-bonded element can be removed using a compound that comprises H₂, NH₃, SiH₄ or Si₂H₆ or a combination thereof. Activation of the reacting gas can be done with a remote plasma which may prevent damage of the substrate (col. 6, line 19 – col. 7, line 40)

With respect to claims reciting the process being free of plasma, both the chemisorbing step and the organic removing step. Kang et al. (7,098,131) teaches a remote plasma (is preferable in some cases” can be used. Hence, it is the Examiner’s position that Kang et al. (7,098,131) also teaches those instances where a plasma is not utilized (pg. 6, lines 22-25 and col. 8, lines 15-17).

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6. Claims 36-64 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kang et al. (7,098,131) in combination with Choi et al. (7,067,420).

Features detailed above concerning the teachings of Kang et al. (7,098,131) are incorporated here.

Kang et al. (7,098,131) fails to teach a direct plasma process versus a remote plasma process.

Choi et al. (7,067,420) teaches forming a metal layer on a semiconductor. The metal layer can be formed by ALD. A chemisorbing layer is applied and then contacted with a ligand removing gas to remove the ligand (abstract). Choi et al. (7,067,420) teaches a remote or direct plasma can be utilized (col. 3, line 59, col. 7, lines 15 and 45 and claim 13).

Therefore it would have been obvious at the time the invention was made to have modified Kang et al. (7,098,131) ALD process by utilizing a direct plasma versus a remote plasma as evidenced by Choi et al. (7,067,420) with the expectation of achieving similar success as Choi et al. (7,067,420) teaches utilizing either a remote or direct plasma for success.

7. Claims 1-4,10,13,16,22-25 and 30-35 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kang et al. (7,098,131) in combination with Kim et al. (6,576,053) further in combination with either Aaltonen et al. (2005/0020060) or Shero et al. (2006/0216419).

Features detailed above concerning the teachings of Kang et al. (7,098,131) are incorporated here.

Kang et al. (7,098,131) fails to teach a removing gas void of hydrogen and/or CO.

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Kim et al. (6,576,053) teaches an ALD process whereby an oxidizing agent such as CO₂, O₃, O₂ and N₂O are used as a second reactant to form the ALD thin film and remove ligands from the first reactant (abstract and col. 2, lines 33-60 and col. 3, lines 29-45).

Therefore it would have been obvious at the time the invention was made to have modified Kang et al. (7,098,131) ALD process by utilizing a direct plasma versus a remote plasma as evidenced by Kim et al. (6,576,053) with the expectation of achieving similar success.

Kang et al. (7,098,131) in combination with Kim et al. (6,576,053) fail to teach the “contacting step” not to include a component in the final layer.

Aaltonen et al. (2005/0020060) teaches an ALD method whereby oxygen containing gas is utilized to remove the ligand by burning and no oxygen is incorporated into the film. This is done with a subsequent reactive gas to form the metal oxide film ([0018]. The oxygen containing gas can include H₂O₂, N₂O, etc. ([0056]).

Shero et al. (2006/0216419) teaches that a reactant can be used to strip the ligands of the previously absorbed species allowing the next reactant to directly react with or absorb upon the monolayer of the first species ([0058]).

Therefore it is the Examiner's position that one skilled in the art at the time the invention was made to have modified Kang et al. (7,098,131) in combination with Kim et al. (6,576,053) process by incorporating a “reactant gas” which strips the ligands without incorporating a component in the final film as evidenced by either Aaltonen et al. (2005/0020060) or Shero et al. (2006/0216419) with the expectation of achieving similar success.

Allowable Subject Matter

8. Claims 26-28 are allowed.

Reasons for Allowance

9. The following is an examiner's statement of reasons for allowance:

The prior art of record fails to teach or fairly suggest forming the ALD metal nitride layer with a chemisorbing step and a contacting step whereby the pressure within the chamber during the chemisorbing step is lower than that of the contacting step which leads to better conductivity.

The prior art teaches a contact pressure and not reason to change the pressure as claimed.

Any comments considered necessary by applicant must be submitted no later than the payment of the issue fee and, to avoid processing delays, should preferably accompany the issue fee. Such submissions should be clearly labeled "Comments on Statement of Reasons for Allowance."

Response to Amendment

10. Applicant's arguments with respect to claims 1-8, 10-17, 22-26 and 29-68 have been considered but are moot in view of the new ground(s) of rejection.

Applicant argued that the prior art fails to teach the claimed process absent a plasma (claim 17).

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With respect to claims reciting the process being free of plasma, both the chemisorbing step and the organic removing step. Kang et al. (7,098,131) teaches a remote plasma (is preferable in some cases” can be used. Hence, it is the Examiner’s position that Kang et al. (7,098,131) also teaches those instances where a plasma is not utilized (pg. 6, lines 22-25 and col. 8, lines 15-17).

Applicant argued that the prior art fails to teach a removing the ligand without adding a component to the final film (claims 1 and 13).

Aaltonen et al. (2005/0020060) or Shero et al. (2006/0216419) teach this limitation as detailed above.

Applicant argued that the prior art teaches a remote plasma but does not teach that the plasma is on prior to, during and after the introduction of the second precursor (claim 36).

The Examiner agrees in part. While the Examiner acknowledges the fact that the references are silent upon the “duration” of the plasma, they do not teach turning the plasma on and off and hence it is the Examiner’s position that the plasma would be “continuous” as there is no suggestion to not do so. In addition, keeping the plasma on would reduce lag time of the process and to achieve the benefits of the final film associated with its use.

Applicant argued that the prior art fails to teach a greater ratio of 1:1 of the components (claim 29).

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The Examiner agrees in part. While the references are silent upon such a ratio, the processes both produce the metal nitride films and hence whether a ration of 1:1 or greater is maintained, one skilled in the art would have an expectation f achieving similar success regardless of this ratio. Furthermore, The term “greater” can be so small as to not be a factor such as 1:1.0000001 which would meet the claimed limitation but not be “critical” to produce an unexpected result. If Applicant were to provide a ‘criticality” to the ratio being greater than 1:1 and a threshold that has to be met to obtain advantages associated therewith, the Examiner will reconsider his position.

11. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Brian K. Talbot whose telephone number is (571) 272-1428. The examiner can normally be reached on Monday-Friday 6AM-3PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner’s supervisor, Timothy H. Meeks can be reached on (571) 272-1423. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

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Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

Handwritten signature of Brian K Talbot and the date 3/19/07.

Brian K Talbot
Primary Examiner
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BKT